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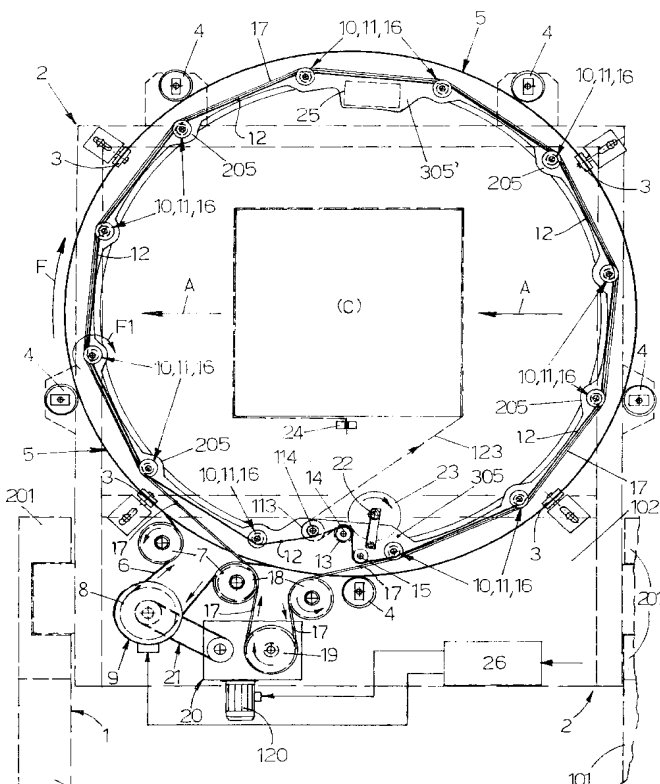
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(54) Title: RING MACHINE FOR WRAPPING PALLETIZED LOADS WITH EXTENDABLE FILM



(57) Abstract: Vertical or horizontal axis ring machine, for wrapping usually palletized loads with extendable film, of the type in which the rotating ring (5) carries, mounted thereon, the reel (23) of wrapping film and at least one pair of rubber-lined and motor-driven 5 rollers (13, 113) for pre-stretching the film unwound from the reel and to be fed to the load to be wrapped, characterized in that the said pre-stretching rollers are actuated by a kinematic chain which is supported rotatably by the said ring (5), which projects from the side of the ring opposite to that from where the said pre-stretching rollers and the reel project and which is designed to be actuated by a motor unit which is 10 situated statically on the frame (2) which rotatably supports the said ring (5) and which acts in phase synchronism with the motor (9) actuating this ring.

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TITLE: "Ring machine for wrapping palletized loads with extendable film"

DESCRIPTION

The invention relates to a ring machine for wrapping usually palletized loads with extendable film so as to fix firmly the said loads on the support pallet and ensure that the whole assembly is in a rigid condition suitable for the transportation and storage operations. In the machines in question, the carriage which supports the reel of extendable film, the rollers for pre-stretching the film unwound from the reel and usually also a jockey wheel for compensation with the means for feedback control of the movement imparted to the said pre-stretching rollers travels together with or on a round annular structure which is arranged with its axis vertically or horizontally and which in the first case is constrained to a support structure with the arrangement of raising and lowering means in between and in the centre of which the load to be wrapped with helical turns of the said pre-stretched film is positioned, while in the second case the said ring structure with the horizontal axis is usually in a static position and the load to be wrapped is displaced with respect to the latter. The leading end of the wrapping film is initially retained by a gripper device with associated cutting means which may be located in a fixed position, laterally with respect to the load or which may be associated with the structure which supports the ring. In this type of known machine, the motor of the pre-stretching unit and the safety devices situated on the rotating carriage are connected to a fixed power supply and control panel by means of an electrical slip ring, for example with a plurality of brushes associated with the said carriage and co-operating with corresponding annular and electrically conductive tracks which are mounted with a suitable electrical insulation coaxially on the said main ring when the said carriage travels on the latter or are mounted on a fixed secondary ring coaxial with the main ring when the latter rotates integrally with the carriage. In order to be able to use these machines in the sectors of the industry which require a high degree of insulation of the electrical systems, it is required to provide the said slip ring and brushes with sealed properties which result in not a few difficult constructional

problems, which increase the production costs of the machine and which require frequent quality checks. In order to ensure better the sealed condition of the slip ring, in some cases the latter is manufactured with small dimensions and is arranged in a condition coaxial with the vertical axis ring and at a height greater than that of the maximum vertical displacement of this component, on the cross-beam of a gantry structure which supports the means for guiding and raising and lowering the said ring and the small moving part of the slip ring is connected to the carriage with the pre-stretching rollers and with the reel, by means of electric cables which are guided in an arm in the form of an overturned L, the vertical section of which has a telescopic form. In other machines of the known type, an electric generator is mounted on the carriage with the pre-stretching rollers or on an oppositely arranged carriage which also performs dynamic balancing functions, said electric generator being activated with rotation of the carriage and providing a back-up power supply for an electric accumulator so as to supply the electric current necessary for activation of the motor of the pre-stretching rollers without any connection externally, also because the whole control and operating logic is mounted on the moving part.

All the known solutions are constructionally complex and are not devoid of operational problems. The invention intends to overcome the drawbacks of the known art with a rotating ring machine as described in the accompanying claims, which adopts the following proposed solution. The ring is mounted rotatably on its support structure and is rotated by a motor which is statically located on this structure. A plurality of pulleys which are angularly equally spaced from each other are mounted on the inner circumference of the ring, rotatable about their axis which is parallel to that of the ring, said pulleys being situated along the whole circumference of the ring and being rotated at the appropriate speed by means of a belt drive system and a static motor unit, in a manner similar to the solution adopted for rotation of the ring. Preferably it is also envisaged that this latter drive system should comprise a variable speed reducer unit which receives the movement from the motor for rotation of the ring and the output speed of which is varied automatically by a servocontrol device driven by a logic which takes into account the dimensions

and any other characteristics of the load to be wrapped. Pinions or other equivalent means are keyed onto the axis of the said pulleys and drive, thereon, a chain or other equivalent means which transmits the necessary rotational movement to the film pre-stretching rollers which are situated on the ring together with the reel for feeding the said film and any other means necessary for wrapping the load with the conveniently pre-stretched film, all of which so as to avoid the use of sealed electrical slip rings and/or avoid all those constructional complications necessarily associated with the prior art, as described above.

Further characteristic features of the invention and the advantages arising therefrom will emerge more clearly from the following description of a preferred embodiment thereof, illustrated purely by way of a non-limiting example, in the figures of the accompanying illustrative plates in which:

- Fig. 1 shows a top plan view of a vertical axis ring machine complete with the various static drive systems and with the film during wrapping of the load;

- Fig. 2 shows a perspective and enlarged view of details relating to the main drive systems of the machine;

- Fig. 3 shows a side elevation view of the detail relating to the drive system of the kinematic chain which actuates the rollers for pre-stretching the film, mounted on the ring.

The description which is now provided with reference to the drawings relates to a vertical axis ring machine, although it is understood that the scope of protection of the invention must be regarded as being extended to include also horizontal axis ring machines. From Figures 1 and 2 it can be seen that the machine comprises a sturdy gantry structure 1 with a base 101 which is designed for stable fixing on the ground and the uprights 201 of which slidably support in a vertically guided manner, under the control of a raising/lowering drive system (not shown since it is known), the broad transverse side 102 of a horizontal quadrangular frame which, for example, projects in cantilever fashion from a side of the structure 1 and which by means of pairs of horizontal-axis pulleys 3 and vertical axis pulleys 4 rotatably supports underneath it a ring 5 which is also horizontal and in the centre of which and underneath which the

load C to be wrapped is positioned, said load, as shown in Figure 1, being moved for example in the direction of the arrows A by special motor-driven rollerways, which are not shown since they are also of the known type. The ring 5 (Figs. 1 and 2) is provided on the outer side with a race 105 which receives at least one belt 6 of the reinforced and endlessly wound type which embraces this ring substantially over the entire circumference, except for a small section along the cross-piece 102 of the frame 2, where the said belt follows a U-shaped path as a result of being driven over a pair of pulleys 7 which are freely rotatably supported by the said cross-piece 102 and a pulley 8 which also has a vertical axis and is keyed onto the shaft of an electric motor 9 preferably of the type with electronic speed and phase control, for example of the brushless type, mounted on a support not shown and also supported by the cross-piece 102. As a result of rotation of the motor 9, the ring 5 rotates for example in the clockwise direction indicated by the arrow F in Figures 1 and 2.

Pinions 11 with the same diameter or equivalent means are mounted rotatably about their vertical axis 10 on projecting flanges 205 which are integral with the inner circumference of the ring 5, are angularly equally spaced from each other and of a suitable number, said pinions driving, thereon, a chain 12 or an equivalent means which surrounds these said pinions and which is kept suitably tensioned by a tensioning device described further below. As a result of being driven over the said pinions 11, the chain 12 must be substantially included within the plan-view dimensions of the ring 5, so that said pinions 11 will be, for example, twelve in number or another suitable amount. From the detail shown in Figure 2 and Figure 1 it can be seen that, between a pair of consecutive flanges 205, the ring 5 also has integral with its inner circumference a flange 305 which is broader than the flanges 205 and which rotatably supports the axes of a pair of rubber-lined rollers 13, 113 which are vertical and close to each other and which extend below the ring 5 and the height of which is suitably greater than that of the wrapping film (see below). The top end of the axis of these rollers have, keyed onto them, pinions 14, 114 with a varying number of teeth, on which the said chain 12 is driven so that the roller 113 rotates, for example, in the same direction F1 as the pinions 11 and the roller 13 rotates in

the opposite direction and the same roller 113 rotates at a speed greater than that of the roller 13 (see below). In Figures 1 and 2, 15 denotes the idle and adjustable pinion which ensures that the chain 12 has the right longitudinal tension and is correctly driven around the pinions 14, 114 of the rollers 13, 113.

5 As shown in the detail of Figures 2 and 3 and also in Figure 1, the axes of the pinions 11 have, keyed on and above them, pairs of pulleys 16 with the same diameter which are situated at a height suitably greater than that of the ring 5 and which drive, on the outside thereof, corresponding pairs of elastic belts 17 which are endlessly wound and which, along the cross-piece 102 of the frame 2, follow a U-shaped path as a
10 result of being driven over two pairs of pulleys 18 which are supported idly by the said cross-piece 102 and as a result of being driven over a driving pulley 19 keyed onto the output shaft of a variable-speed reducer 20 which is also mounted on the cross-piece 102 and which, by means of a positive drive transmission 21, is actuated at its input by the shaft of the same motor 9 which causes rotation of the ring 5. 120
15 denotes the bidirectional motor with electronic speed and phase control which is able to modify the adjustment so as to vary the output speed of the unit 20 and therefore the speed of rotation of the rubber-lined rollers 13, 113 depending on the characteristics of the load C to be wrapped (see below). As a result of rotation of the pulley 19, the pairs of elastic belts 17 are rotated in the same direction F of rotation
20 as the ring 5 and at a speed such that the said pinions 11 must rotate at a suitable speed in the direction of the arrow F1. The polygonal and non-round shape of the section of the belts 17 driven over the pulleys 16 whenever the set of these pulleys passes opposite the static pulleys 18, produces in the said belts 17 small cyclical variations in longitudinal tension which are easily compensated for by the elasticity of
25 these belts 17.

The spindle 22 which supports the reel 23 of extendable film is mounted underneath the said flange 305 which supports the pair of vertical and parallel rubber-lined rollers 13, 113, parallel to said rollers, said reel being controlled by any suitable known means for unwinding the film, for example friction means and/or means which keep it
30 tangentially co-operating with the first rubber-lined roller 13. The film 123 which is

unwound from the reel 23 is driven over the first rubber-lined roller 13 and then over the second rubber-lined roller 113 so that, on the exit side of these rollers, the said film is suitably pre-stretched, for example only in the longitudinal direction or both in the longitudinal direction and in the transverse direction, depending on the known form of the surfaces of the said pre-stretching rollers. Upon leaving the pre-stretching rollers 13, 113 the film 123 may reach the known gripping, cutting and fixing means which are situated laterally with respect to the load C, directly as shown in the example of Figure 1, or after being driven over a jockey wheel of the mechanical type and/or over a roller having, associated with it, a sensor or means which detect the tension of the outgoing film and which emit a modulated and proportionally adjusted radio signal which is received by radio-receiver means situated on the cross-piece 102 and which are designed to modulate conveniently the operation of the servocontrol device 120, the said radio transceiver means being powered by a small rechargeable long-life battery, for example of the lithium type.

The weight created in an eccentric position on the ring 5 by the pair of pre-stretching rollers 13, 113, by the reel 23 and by any compensating jockey wheel may be conveniently balanced by a ballast weight 25 which is situated on an internal flange 305' of the said ring 5, in a position diametrically opposite to the flange 305 with the said rollers 13, 113.

Operation of the machine as described is simple and entirely similar to that of a machine of the known type, with the difference that the ring 5 is now without the electric motor and any variable-speed reducer for actuating the pre-stretching rollers and consequently without the electrical slip ring for operation of this motor and the associated self-regulating means since the said pre-stretching rollers are now operated by the motor unit 20 situated in a remote and static position such that the machine has a more simplified structure and is able to operate at speeds higher than those of the conventional machines, owing to the lesser inertia of the ring 5 and the means associated with it. The variations in tension affecting the film, due to the different characteristics relating to the dimensions and/or form and/or nature of the load to be wrapped, may be easily compensated for with variations in the speed of

the pre-stretching rollers and with consequent action on the actuator 120 of the unit 20, on the basis of a special operating program provided in the machine or as a result of the action of any said voltage compensation and/or control means situated downstream of the pre-stretching rollers. This adjustment may be performed
5 automatically using a software which takes account of the characteristics, form and dimensions of the load, which are introduced in each case into the processor 26 which controls the units 9 and 20, manually and/or using self-learning means. In the machine as shown in Figure 1, wrapping of the load is completed with known operations involving raising and lowering of the frame 2 so that the palletized load is
10 wrapped by one or more helical wound turns of film which are partially superimposed on each other. During the final stage, the film is again gripped by the gripping, cutting and fixing unit 24 and the wound load may again be moved away or replaced by a new load to be wrapped.

It is understood that the description refers to a preferred embodiment of the
15 invention, to which numerous constructional modifications and variations may be made. One of these modifications may, for example, relate to the fact that the pinions 11 may be eliminated or replaced by a ring with inner teeth which is rotatably and coaxially supported by the ring 5, above the latter, and designed so as to be actuated with a belt by the said driving pulley 19 in a static position, in the same
20 manner as the ring 5, and which with its inner teeth transmits the necessary rotation to at least one or both the gearwheels replacing the said pinions 14, 114 of the pre-stretching rollers 13, 113.

CLAIMS

1. Vertical or horizontal axis ring machine, for wrapping usually palletized loads with extendable film, of the type in which the rotating ring (5) carries, mounted thereon, the reel (23) of wrapping film and at least one pair of rubber-lined and motor-driven rollers (13, 113) for pre-stretching the film unwound from the reel and to be fed to the load to be wrapped, characterized in that the said pre-stretching rollers are actuated by a kinematic chain which is supported rotatably by the said ring (5), which projects from the side of the ring opposite to that from where the said pre-stretching rollers and the reel project and which is designed to be actuated by a motor unit which is situated statically on the frame (2) which rotatably supports the said ring (5) and which acts in phase synchronism with the motor (9) rotationally actuating the said ring (5).
2. Machine according to Claim 1, in which the said kinematic chain which actuates the said pre-stretching rollers (13, 113) comprises a plurality of pinions (11) or equivalent means mounted rotatably on special supports (205) fixed to the inner circumference of the ring (5), arranged with their axis parallel to that of the ring, equally spaced from each other and being of a number such that a chain (12) or other suitable means driven on the latter does not have to project excessively from the plan dimensions of the said ring (5), it being envisaged that this chain transmits the necessary rotation to the pinions of the pre-stretching rollers (13, 113) and it being envisaged that the said axes of the said pinions (11) have, keyed onto them, pairs of pulleys (16) with the same diameter which drive, thereon, corresponding elastic belts (17) which, along one side (102) of the frame (2) which rotatably supports the said ring (5), are made to follow a U-shaped path for driving over a pair of idle pulleys (18) and over a driving pulley (19) situated statically on the said side (102) of the frame (2).
3. Machine according to Claim 1, in which the said kinematic chain which

actuates the pre-stretching rollers (13, 113) comprises a ring with internal teeth rotatably and coaxially supported by the main ring (5) and designed so that it can be actuated with a belt by a motor unit situated statically on one side (102) of the frame (2) which supports the said main ring (5) and which with its internal teeth transmits the necessary rotation to at least one or both the pinions of the said pre-stretching rollers (13, 113).

4. Machine according to Claim 1, in which the static motor unit which actuates the kinematic chain driving the pre-stretching rollers (13, 113) comprises a variable-speed reducer (20) which by means of a positive drive transmission (21) is actuated at its input by the said motor (9) for rotation of the main ring (5) and which is provided with a servocontrol device (120) which may vary the output speed of this device (20) and consequently the speed of rotation of the pre-stretching rollers, using any suitable means designed to produce the said variation in speed depending on the dimensions, the form and/or the characteristics of the load (C) to be wrapped, so as to keep the longitudinal tension of the film which wraps the said load at sufficiently constant values.

5. Machine according to Claim 4, characterized in that the adjustment of the output speed of the variable-speed reducer (20) may be performed automatically using software which takes account of the characteristics, the form and the dimensions of the load, which are in each case introduced manually and/or using self-learning means into the processor (26) which controls the motor units (9, 20) of the said machine.

6. Machine according to Claim 4, characterized in that adjustment of the output speed of the variable-speed reducer (20) may be performed automatically by means of jockey wheel or a roller which is situated downstream of the pre-stretching rollers (13, 113) and which drives, thereon, the film which leaves the said rollers (13, 113), said roller having, associated with it, a sensor and means which detect the tension of

the film fed to the load and which transmit a radio modulated and proportionally adjusted signal which is received by radio receiver means situated on the frame (2) which rotatably supports the main ring (5) and which act on the processor (26) in order to modulate conveniently the operation of the servocontrol device (120) of the
5 variable-speed reducer (20) so as to keep the tension of the wrapping film at sufficiently constant values, the said radio transceiver means being powered by a small rechargeable long-life battery, for example of the lithium type.

7. Machine according to Claim 4, in which a jockey wheel with one or more
10 transmission rollers may be provided downstream of the pre-stretching rollers (13, 113), for mechanical compensation of the tension of the film which leaves the said pre-stretching rollers and is directed towards the load to be wrapped.

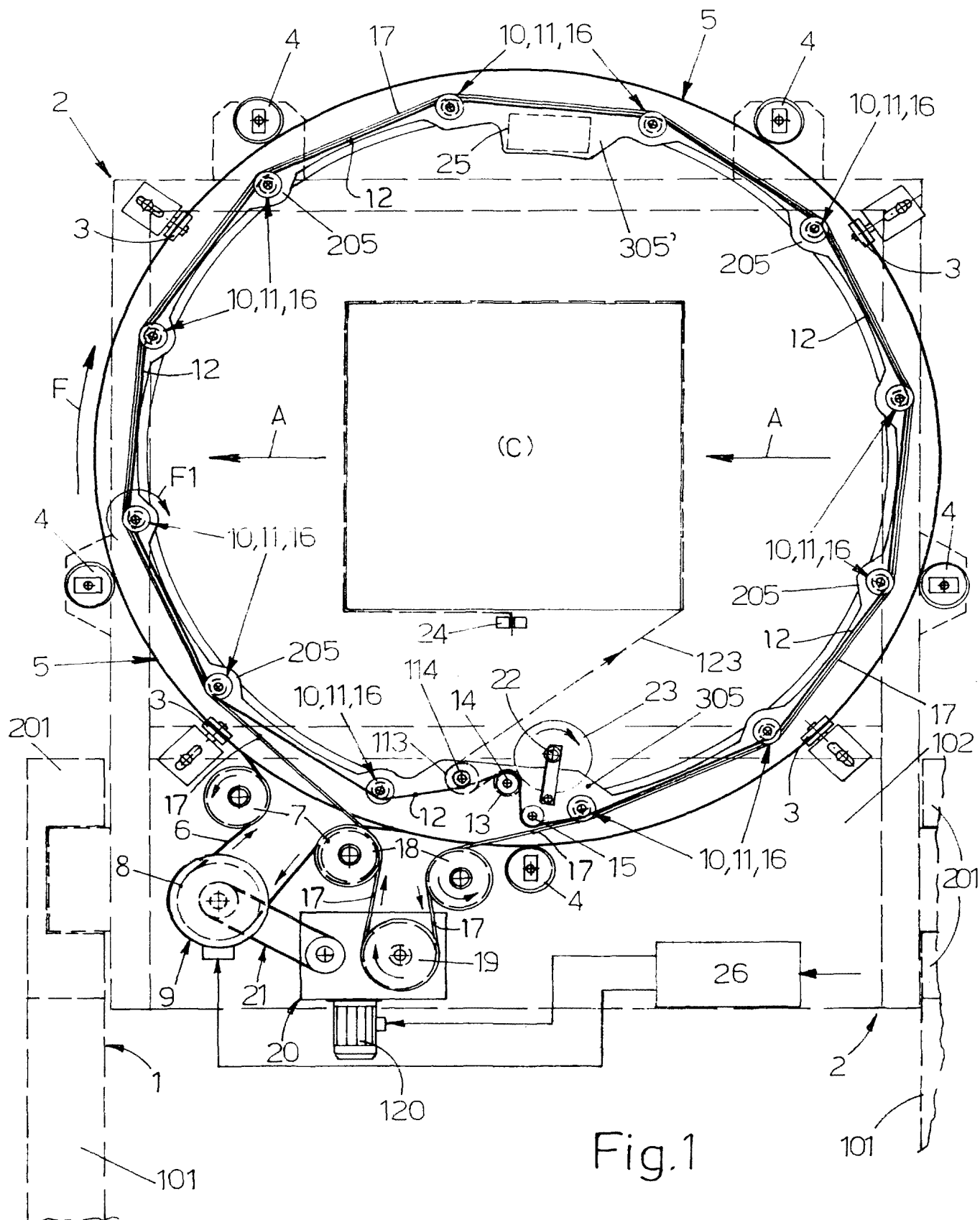
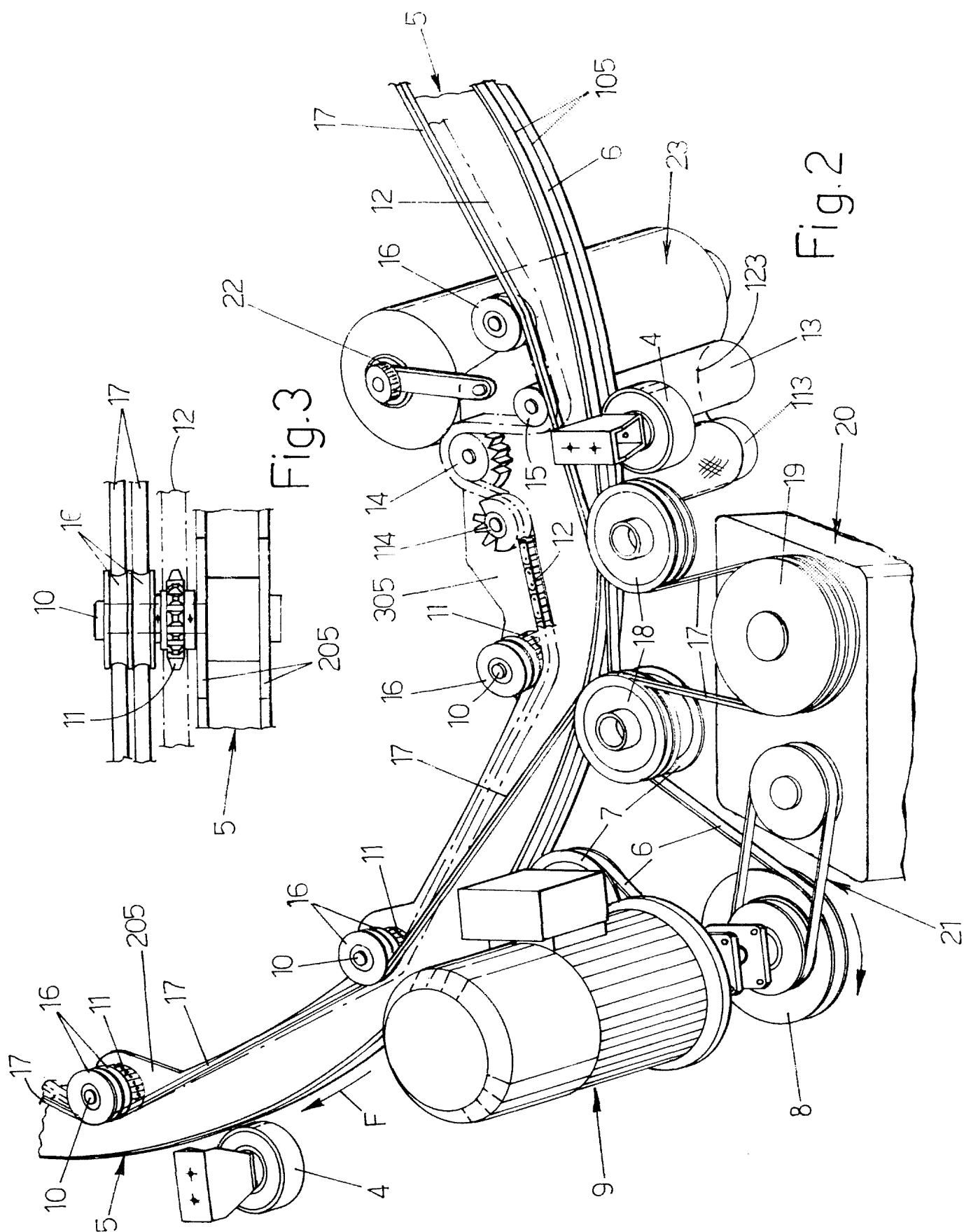


Fig.1



INTERNATIONAL SEARCH REPORT

International application No

PCT/EP2006/069592

A. CLASSIFICATION OF SUBJECT MATTER

INV. B65B11/00 B65B11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
B65B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Further documents are listed in the continuation of Box C.



See patent family annex.

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INTERNATIONAL SEARCH REPORT

International application No

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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INTERNATIONAL SEARCH REPORT

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International application No

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